

(12) INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(19) World Intellectual Property Organization
International Bureau(43) International Publication Date
22 August 2002 (22.08.2002)

PCT

(10) International Publication Number
WO 02/064391 A1(51) International Patent Classification⁷: B60J 7/14, 7/185Jean-Marc [FR/FR]; Les Maisons Blanches, F-79140 Ciri-
eres (FR).

(21) International Application Number: PCT/EP01/14079

(74) Agent: BOUJU DERAMBURE BUGNION; 52 rue de
Monceau, F-75008 Paris (FR).

(22) International Filing Date: 3 December 2001 (03.12.2001)

(25) Filing Language: English

(81) Designated States (*national*): JP, US.

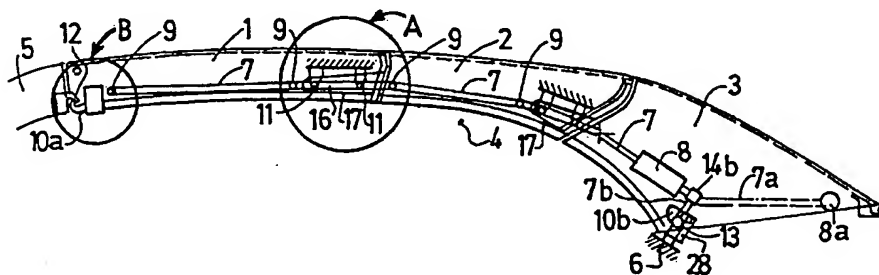
(26) Publication Language: English

(84) Designated States (*regional*): European patent (AT, BE,
CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC,
NL, PT, SE, TR).(30) Priority Data:
01 02015 14 February 2001 (14.02.2001) FRDeclaration under Rule 4.17:
— of inventorship (Rule 4.17(iv)) for US only(71) Applicant (*for all designated States except US*): FRANCE
DESIGN [FR/FR]; Lieu-Dit La Boujalière, F-79140 Le Pin
(FR).Published:
— with international search report

(72) Inventors; and

(75) Inventors/Applicants (*for US only*): QUEVEAU, Gérard
[FR/FR]; "Amik Farm", F-79140 Le Pin (FR). GUILLEZ,For two-letter codes and other abbreviations, refer to the "Guid-
ance Notes on Codes and Abbreviations" appearing at the begin-
ning of each regular issue of the PCT Gazette.

(54) Title: A RETRACTABLE ROOF WITH A LOCKING DEVICE IMPROVING THE RIGIDITY OF THE ROOF



(57) Abstract: The retractable roof for a vehicle comprises several rigid roof elements (1, 2, 3), able to move between a position in which they cover the passenger compartment (4) of the vehicle and a position in which they are stored inside the rear boot of the vehicle, the roof elements (1, 2, 3) being, when they cover the passenger compartment (4), connected to each other and to the front and rear parts of the bodywork by locking means controlled by rods (7) extending inside the roof elements, driven in rotation by an electric motor (8) housed in a rear roof element. The locking means comprise, for each roof element (1, 2, 3), at least one pivoting hooked locking finger cooperating with a fixed finger (11) secured to an adjacent roof element or with a complementary fixed locking member (12, 13) secured to the front (5) or rear (6) part of the bodywork, the pivoting of each pivoting hooked locking finger being controlled by the translational movement of a nut mounted on a threaded part of one (16) of the said rods driven in rotation by an electrical motor (8).

WO 02/064391 A1

WO 02/064391

PCT/EP01/14079

1

A retractable roof with a locking device improving the rigidity of the roof

The invention relates to a retractable roof for vehicles comprising several rigid roof elements able to move between a position in which they cover the passenger compartment of the vehicle and a position in which they are stored in the rear boot of the vehicle.

Such a retractable roof makes it possible to convert a vehicle of the saloon or coupé type into a vehicle of the cabriolet type.

In known designs, the roof elements are, when they cover the passenger compartment, connected to each other and to the front and rear parts of the bodywork by locking means controlled by rods extending inside the roof elements, driven in rotation by an electric motor housed in a rear roof element.

Such locking means were described in the French patent application N° 99 03 234 filed in the name of the applicant.

Such a system makes it possible to centralise the control for locking the roof elements together and with the bodywork using a single electric motor.

The aim of the present invention is to improve the above locking system, so that it helps to improve the rigidity of the retractable roof, when it covers the passenger compartment of the vehicle and the roof elements are locked together and with the bodywork.

According to the invention, this retractable roof is characterised in that the locking means comprise, for each roof element, at least one pivoting locking finger with a hook, cooperating with a fixed finger secured to an adjacent roof element or with a fixed complementary locking member secured to the front or rear part of the bodywork, the pivoting of each pivoting locking finger with a hook being controlled by the translational movement of a nut mounted on a threaded part of one of the said rods driven in rotation by an electric motor.

The above locking system makes it possible to lock the roof elements together in a longitudinal direction and in a perpendicular direction, with a clamping effect

WO 02/064391

PCT/EP01/14079

2

obtained by means of the action of the screws on the fingers with hooks, which makes it possible to obtain connections resisting bending and twisting forces.

Thus the retractable roof equipped with such a locking system actively participates in the rigidity of the whole of the vehicle bodywork.

5 Other particularities and advantages of the invention will emerge below.

In the drawings attached by way of non-limitative examples:

- Figure 1 is a schematic view in longitudinal section of a retractable roof according to the invention equipped with a locking system;
- Figure 2 is a view to an enlarged scale of detail A in Figure 1;
- 10 - Figure 3 is a plan view in the direction of the arrow F in Figure 2;
- Figure 4 is a view in section along the plane IV-IV in Figure 2;
- Figure 5 is a view in section along the plane V-V in Figure 2;
- Figure 6 is a view to an enlarged scale of detail B in Figure 1;
- Figure 7 is a view in the direction of the arrow F₁ in Figure 6.

15 In the example depicted in Figure 1, the retractable roof comprises three rigid roof elements 1, 2, 3 able to move between a position (the one depicted in Figure 1) in which they cover the passenger compartment 4 of the vehicle and a position (not shown) in which they are stored inside the rear boot of the vehicle.

When they cover the passenger compartment 4, the roof elements 1, 2, 3 are
20 connected to each other and to the front 5 and rear 6 parts of the bodywork by locking means controlled by rods 7 extending inside the roof elements 1, 2, 3 driven in rotation by an electric motor 8 housed in the rear roof element 3.

The rods 7 can be rigid. In this case, they are connected together by cardan joints 9. These rods 7 can also be flexible.

WO 02/064391

PCT/EP01/14079

3

An electric motor 8 can be disposed on each side of the rear roof element 3. A single motor 8a could be disposed at the middle of the rear element 3 and be connected to the rods 7 by rods 7a.

5 In accordance with the invention, the locking means comprise (see Figures 2, 3, 6), for each roof element 1, 2, 3, pivoting locking fingers with hooks 10, 10a, 10b cooperating with fixed fingers 11 secured to an adjacent roof element 1, 2 or with a fixed complementary locking element 12, 13 secured to the front 5 or rear 6 part of the bodywork. The pivoting of each pivoting locking finger with hooks 10, 10a, 10b is controlled by the translational movement of a nut 14, 14a, 14b mounted on a threaded part 15 of a rod 16, 16a driven in rotation by the
10 electric motor 8.

In the embodiment depicted, the roof elements 1, 2, 3 are associated with each other so as to be able to move with respect to each other in a transverse direction with respect to their surface, when they are moved from their position
15 of covering the passenger compartment 4 to their position of storage in the boot.

In addition, each roof element 2, 3, with the exception of the front element 1, has on its front end a protuberance 17 engaging under the adjacent roof element 1, 2. Each protuberance 17 has two transverse slots 18, splayed and spaced apart longitudinally, able to receive two fixed locking fingers 11 secured
20 to the adjacent roof element 1, 2.

Each protuberance 17 also carries a rod 16 mounted for rotation and connected by the rods 7 to the electric motor 8.

The rod 16 has two threaded parts 15 on each of which a nut 14 is mounted.
25 Each nut 14 has a lateral stud 19 (see Figure 3) in engagement with a hooked locking finger 10 mounted so as to pivot on a shaft 20 secured to the protuberance 17. The hook on each locking finger 10 can come into engagement with one of the two fingers 11 engaged in a splayed slot 18 in the protuberance 17, in order to lock the finger in the corresponding slot 18.

WO 02/064391

PCT/EP01/14079

4

Moreover, the end of the rotary rod 16 carried by the protuberance 17 has means 21 for coupling and uncoupling it from the end of the rod 7 carried by the adjacent roof element 1, 2 when the roof elements 1, 2, 3 are associated with each other or disconnected from each other.

5 As shown notably by Figure 4, the said coupling and uncoupling means comprise a rod end 16 having two flats 16a, opposite with respect to the axis of the rod, able to engage in a complementary recess 22 formed at the end of the rod 7 carried by the adjacent roof element 1, 2.

10 In addition, this recess 22 opens out towards the outside through a splayed opening 23 directed in the direction of association of the roof elements, so that, during this association, the end of the rod 16 can engage in the recess 22.

As shown by Figures 1 and 6, the front end of the front roof element 1 carries a pivoting hook 10a able to come into engagement with a locking cavity 12 fixed to the front part 5 of the bodywork. The pivoting of this hook 10a is controlled
15 by the translational movement of a nut 14a mounted on the threaded end 16a of a rotary rod 7. The nut 14a has a finger 24 in engagement in a groove 25 formed in the base of the hook 10a.

In addition, the front end of the front element 1 carries a conical protuberance 26 directed downwards and towards the front part 5 of the bodywork. The latter
20 has a recess 27 able to receive the conical protuberance and has a shape complementary to the latter.

As shown by Figure 1, the rear part 6 of the bodywork has a locking finger 13 able to engage in a splayed slot formed in a plate 28 fixed to the rear part of the rear roof element 3. A pivoting locking finger 10b is able to come into
25 engagement with the locking finger 13 in order to lock it in the slot in the plate 28.

The pivoting of the pivoting finger 10b is controlled by the rotation of a rod 7b driven by the electric motor 8.

WO 02/064391

PCT/EP01/14079

5

The functioning of the locking system which it is wished to describe will now be explained.

It will be assumed that the retractable roof had just been moved, by means of a known mechanism, from a position of storage inside the boot of the vehicle, to
5 the covering position depicted in Figure 1.

In this position, the rear element 3 is in contact with the rear part of the bodywork, the elements 3, 2, 1 are situated in line with each other and the front element 1 is situated opposite the front part 5 adjacent to the windscreen.

The protuberances 17 carried by the rear 3 and intermediate 2 elements are
10 engaged under the adjacent elements 2 and 1.

In this position, the two fingers 11 carried by each of the elements 1 and 2 are engaged in the splayed slots 18 in the protuberances 17.

The hooked fingers 10, 10a, 10b are released from the fixed fingers 11, 13 and from the locking cavity 12.

15 In addition, the rods 7, 16 and 16a are coupled with each other.

In order to lock the assembly, it suffices to demand the starting of the electric motor 8.

This rotates the rods 7, 16, 16a, 7b.

The rotation of these rods causes the translational movement of the nuts 14,
20 14a, 14b and the tilting of the hooked fingers 10, 10a, 10b.

These fingers 10, 10a, 10b thus lock against the fixed fingers 11, 13 and against the internal face of the cavity 12.

The above locking system confers on the whole of the retractable roof excellent rigidity under bending and twisting.

WO 02/064391

PCT/EP01/14079

6

CLAIMS

1. A retractable roof for a vehicle, comprising several rigid roof elements (1, 2, 3), able to move between a position in which they cover the passenger compartment (4) of the vehicle and a position in which they are stored inside the rear boot of the vehicle, the roof elements (1, 2, 3) being, when they cover the passenger compartment (4), connected to each other and to the front and rear parts of the bodywork by locking means controlled by rods (7) extending inside the roof elements, driven in rotation by an electric motor (8) housed in a rear roof element (3), characterised in that the locking means comprise, for each roof element (1, 2, 3), at least one pivoting hooked locking finger (10, 10a, 10b), cooperating with a fixed finger (11) secured to an adjacent roof element or with a complementary fixed locking member (12, 13) secured to the front (5) or rear (6) part of the bodywork, the pivoting of each pivoting hooked locking finger (10, 10a, 10b) being controlled by the translational movement of a nut (14, 14a) mounted on a threaded part of one (16) of the said rods driven in rotation by an electric motor (8).
2. A retractable roof according to Claim 1, characterised in that the roof elements (1, 2, 3) are associated with each other so as to be able to move with respect to each other in a transverse direction with respect to their surface, when they are moved from their position of covering the passenger compartment (4) to their position of storage in the boot.
3. A retractable roof according to Claim 2, characterised in that each roof element (2, 3), with the exception of the front element (1), has on its front end a protuberance (17) engaging under the adjacent roof element (1, 2), the said protuberance (17) having two transverse slots (18) splayed and spaced apart longitudinally and able to receive two fixed locking fingers (11) secured to the adjacent roof element (1, 2), the said protuberance (17) also carrying a rod (16) mounted for rotation and connected to the said electric motor (8), this rod (16) having two threaded parts (15) on each of which there is mounted a nut (14), each nut having a lateral stud (19) in engagement with a hooked locking finger (10) mounted so as to pivot on a shaft (20) fixed to the said protuberance (17),

WO 02/064391

PCT/EP01/14079

7

the hook on each locking finger (10) being able to come into engagement with one of the two fingers (11) engaged in a splayed slot (18) in the said protuberance, in order to lock the said finger in the said slot.

4. A retractable roof according to Claim 3, characterised in that the end of
5 the rotating rod (16) carried by the said protuberance (17) has means (21) for coupling it to and uncoupling it from the end of the rod (7) carried by the adjacent roof element, when the roof elements are associated with each other or dissociated from each other.

5. A retractable roof according to Claim 4, characterised in that the said
10 coupling and uncoupling means (21) comprise a rod end (16) having two flats (16a) opposite with respect to the axis of the rod, able to engage in a complementary recess (22) formed at the end of the rod (7) carried by the adjacent roof element, this recess (22) opening towards the outside through a splayed opening (23), directed in the direction of association of the two roof
15 elements.

6. A retractable roof according to one of Claims 1 to 5, characterised in that the front end of the roof element (1) carries a pivoting hook (10a) able to come into engagement with a locking cavity (12) fixed to the front part (5) of the bodywork, the pivoting of this hook (10a) being controlled by the translational
20 movement of a nut (14a) mounted on the threaded end (16a) of a rotating rod, this nut having a finger (24) in engagement in a groove (25) formed in the base of the said hook (10a).

7. A retractable roof according to Claim 6, characterised in that the front end of the front element (1) comprises a conical protuberance (26) directed
25 towards the front part (5) of the bodywork, the latter having a recess (27) able to receive the said conical protuberance (26) and being complementary in shape to the latter.

8. A retractable roof according to one of Claims 1 to 7, characterised in that the rear part (6) of the bodywork of the rear roof has a locking finger (13) able to
30 engage in a splayed slot formed in a plate (28) fixed to the rear part (6) of the

WO 02/064391

PCT/EP01/14079

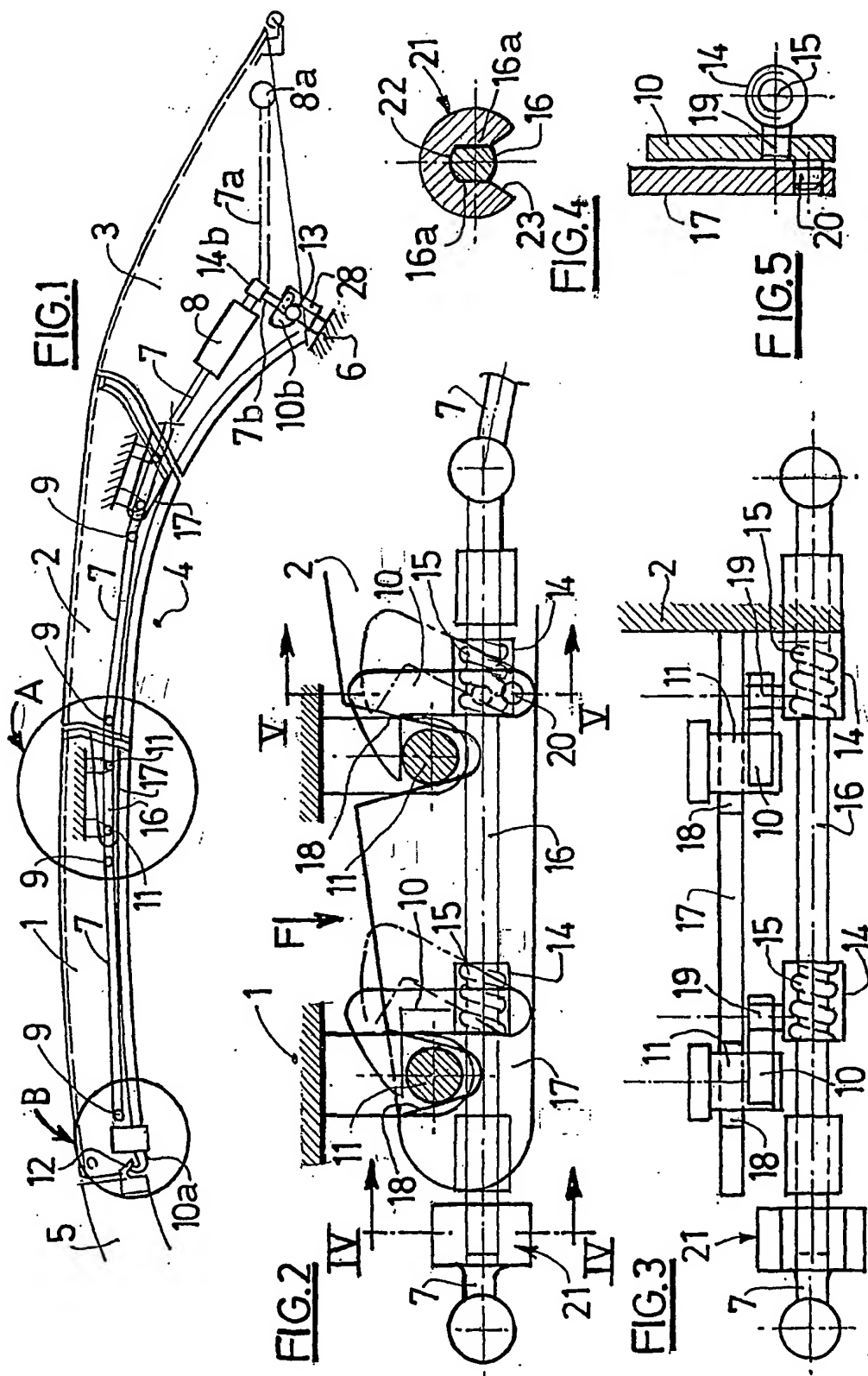
8

rear roof element (3), a pivoting locking finger (10b) being able to come into engagement with the said locking finger in order to lock it in the said slot, the pivoting of the said pivoting finger (10b) being controlled by the rotation of a rod (7b) driven by the electric motor (8).

WO 02/064391

1/2

PCT/EP01/14079



WO 02/064391

2/2

PCT/EP01/14079

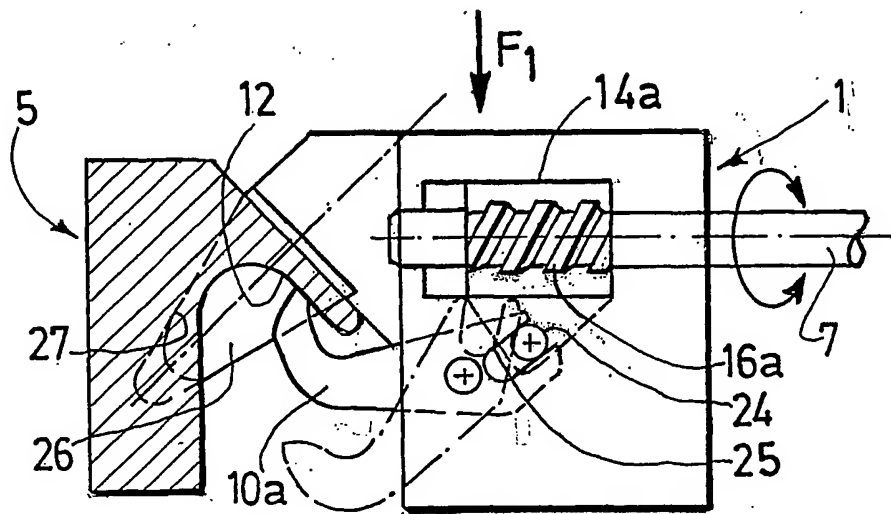


FIG. 6

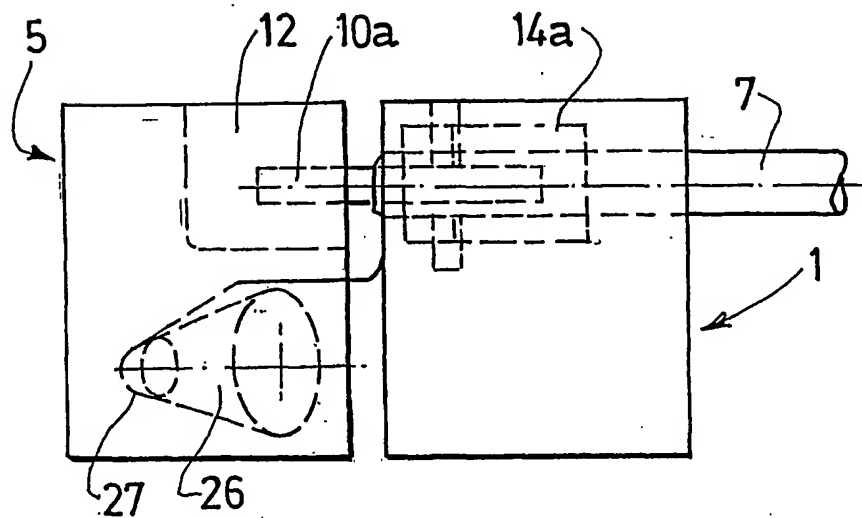


FIG. 7

INTERNATIONAL SEARCH REPORT

International Application No
PCT/EP 01/14079

A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 B60J7/14 B60J7/185

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 B60J

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the International search (name of data base and, where practical, search terms used)

EPO-Internal

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 884 208 A (VALMET AUTOMOTIVE OY) 16 December 1998 (1998-12-16) column 4, line 48 -column 5, line 19; figures 3,4	1
A	DE 39 03 358 A (BAYERISCHE MOTOREN WERKE AG) 30 August 1990 (1990-08-30) column 2, line 61 -column 3, line 26; figure 1	1
A	DE 195 39 086 C (WEBASTO KAROSSERIESYSTEME) 31 October 1996 (1996-10-31) the whole document	1

☐ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

- *A* document defining the general state of the art which is not considered to be of particular relevance
- *E* earlier document but published on or after the international filing date
- *L* document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- *O* document referring to an oral disclosure, use, exhibition or other means
- *P* document published prior to the international filing date but later than the priority date claimed

- *T* later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
- *X* document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
- *Y* document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.
- *G* document member of the same patent family

Date of the actual completion of the international search

8 May 2002

Date of mailing of the international search report

21/05/2002

Name and mailing address of the ISA

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040, Tx. 31 651 epo nl,
Fax: (+31-70) 340-3016

Authorized officer

Foglia, A

INTERNATIONAL SEARCH REPORT

International Application No

PCT/EP 01/14079

Patent document cited in search report		Publication date	Patent family member(s)	Publication date
EP 0884208	A	16-12-1998	FI 102468 B1 EP 0884208 A1 US 6033008 A	15-12-1998 16-12-1998 07-03-2000
DE 3903358	A	30-08-1990	DE 3903358 A1	30-08-1990
DE 19539086	C	31-10-1996	DE 19539086 C1	31-10-1996